Thesis Project Portfolio

Synthesis of Computer Vision and Website Design Principles for Misinformation-Screening Website

(Technical Report)

Identifying Major Themes in Anti-vaccination Misinformation Surrounding the COVID Vaccine and Childhood Vaccines

(STS Research Paper)

An Undergraduate Thesis

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Table of Contents

Sociotechnical Synthesis

Misinformation has always existed, but the globalizing influence of the Internet allows it to spread further than ever before. Strategies to combat misinformation have been developed, but they often fall short of stopping it completely. Decreasing the effects of misinformation is extremely important; for example, during the COVID-19 pandemic health and vaccine misinformation contributed to decreased COVID-19 vaccine uptake rates in the United States, thereby lengthening the pandemic and causing preventable fatalities. Both projects in this portfolio discuss new strategies to combat misinformation. The technical capstone report proposes a design for a misinformation-checking website and discusses how two computer science classes offered at the University of Virginia, CS 3240: Advanced Software Design and CS 4501: Computer Vision, teach skills that would be useful in the construction of such a site. The science, technology, and society (STS) research paper discusses prevalent themes in anti-vaccination misinformation, formalizes the ways in which people interact with that misinformation, and presents ways in which strategies to combat misinformation could be improved. Eliminating misinformation is a difficult task, and examining approaches from multiple disciplines as was done for both projects offers insight into additional ways to curb the effects of misinformation.

The Internet allows an incredible amount of connection, but it also allows misinformation to spread at an unprecedented rate—via social media platforms, for example. Many social media platforms screen user-generated content for the purpose of flagging misinformation, but in some cases the fact-checking algorithms only focus on text-based content, not images or videos. Moreover, the public usually only interacts with algorithmic fact-checking in environments where they are one step removed from the fact-checker: many social media sites employ

fact-checkers, but there is no way for users to submit posts to a fact-checker on their own. By combining skills learned from CS 3240: Advanced Software Design and CS 4501: Computer Vision, two upper-level computer science courses offered at the University of Virginia, a developer could create a website that screens uploaded images for misinformation. Advanced Software Design covers best practices in web development, facilitating the development of the website, and the image processing techniques covered in Computer Vision would allow the site to extract text from images, which could then be screened for misinformation. The capstone report details the ways in which the skills learned in both classes could be applied in the development of the proposed site.

Controlling the spread of misinformation in the highly connected modern world is always important, but is especially so in public health crises like pandemics. Misinformation proved especially problematic during the COVID-19 pandemic, when trust in science and public health officials was eroded and vaccine uptake rates were decreased by the rapid spread of misinformation. Health misinformation, and more specifically vaccine misinformation, is not a new phenomenon; for example, a paper published in 1998 linked the measles, mumps, and rubella (MMR) vaccine to the development of autism in young children, leading to decreased vaccine uptake rates. Decreased uptake rates allow diseases to remain in populations where higher uptake rates would have eradicated them. When diseases remain in populations, variants can form (as has happened with COVID-19) and outbreaks continue. Low MMR vaccination rates led to outbreaks of measles, a disease considered eradicated in the United States by the World Health Organization (Centers for Disease Control and Prevention, 2020), in the US, the United Kingdom, and Canada in 2008 and 2009 (Rao & Andrade, 2011). This paper will compare the main themes present in both childhood and COVID-19 vaccine misinformation and

explore how that comparison can be used to improve strategies that counter misinformation. Additionally, the co-production framework will be used to explore and formalize the interactions between society and vaccine misinformation. In this STS research paper, formalizing both the common themes present in misinformation and the ways in which people interact with that misinformation will lend insight into how strategies that counter misinformation can be more effective.

Presenting both deliverables in one portfolio allows for a multidisciplinary approach to combating misinformation, especially vaccine misinformation. The STS research paper provides valuable background information about the misinformation landscape and discusses events in which vaccine misinformation had negative effects, illustrating the importance of improving strategies to curb the effects and spread of misinformation. The STS paper also details ways in which misinformation-fighting strategies can be improved. The technical capstone also provides a way to combat misinformation by proposing a design for a misinformation-screening website. Moreover, the technical report details ways in which the computer science curriculum at the University of Virginia can prepare students to build such a website, which is a project with real-world impact. Both projects provide insight into how the spread of misinformation can be slowed, benefitting society.

References

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Rao, T. S., & Andrade, C. (2011). The MMR vaccine and autism: Sensation, refutation, retraction, and fraud. *Indian journal of psychiatry*, 53(2), 95–96. https://doi.org/10.4103/0019-5545.82529